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UNITED STATES PATENT AND TRADEMARK OFFICE

This is a U.S. Patent Application for:

Title: METHODS AND APPARATUS FOR TRANSMITTING ACCURATE
EMERGENCY LOCATION IDENTIFICATION NUMBERS (ELINs) AFTER AN
EMERGENCY CALLER DISCONNECTS

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PATENT APPLICATION

5 METHODS AND APPARATUS FOR TRANSMITTING ACCURATE EMERGENCY
LOCATION IDENTIFICATION NUMBERS (ELINs) AFTER AN
EMERGENCY CALLER DISCONNECTS

This application is related to co-owned co-
10 pending application Serial Number ---- entitled "Methods
And Apparatus For Transmitting Accurate Emergency
Location Identification Numbers (ELINs) From Behind A
Multiline Telephone System (MLTS) Utilizing Port
Equipment Numbers"; co-owned co-pending application
15 Serial Number ---- entitled "Priority Based Methods And
Apparatus for Transmitting Accurate Emergency Location
Identification Numbers (ELINs) From Behind A Multiline
Telephone System (MLTS)"; co-owned co-pending application
Serial Number ---- entitled "Methods And Apparatus For
20 Transmitting Over A Private Network Accurate Emergency
Location Identification Numbers (ELINs) From Behind A
Multiline Telephone System (MLTS)"; co-owned co-pending
application Serial Number ---- entitled "Methods And
Apparatus For Transmitting Accurate Emergency Location
25 Identification Numbers (ELINs) From Behind A Multi-Line
telephone System (MLTS) After An Emergency Caller
Disconnects"; co-owned co-pending application Serial
Number ---- entitled "Methods And Apparatus For Dialing
An Emergency Telephone Number From A Teleworking Client
30 Remotely Coupled To A PBX"; and co-owned co-pending

application Serial Number ---- entitled "System For
Dialing An Emergency Telephone Number From A Teleworking
Client Remotely Coupled To A PBX", the complete
disclosures of which are hereby incorporated by
5 reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

10 This invention relates to telecommunications
systems, especially PBX/Server systems, also referred to
as Multi-Line Telephone Systems (MLTS). Specifically,
the invention relates to completing an emergency, e.g.
911, call from a station/device and delivering precise
15 location information of the caller when the emergency
caller disconnects immediately.

2. Brief Description of the Prior Art

 When a caller calls an emergency number, e.g.
20 911, the call is routed to a Public Safety Answering
Point (PSAP). In some jurisdictions, regulatory agencies
require that the caller's telephone number/callback
number and/or precise physical location referred to as an
Emergency Location Identification Number (ELIN), be
25 automatically provided to the PSAP. This information is
used to locate the caller and to call back to the caller
should there be a disconnect.

A caller identification (i.e., telephone number and ELIN) may be delivered to the PSAP either in-band (e.g., using DTMF signaling) or out-of-band (e.g., using
5 ISDN signaling) depending on the type of trunk circuit employed. For residential callers Caller ID number is sufficient for the PSAP. For PBX/server service many users, e.g., commercial callers, hotel guests; an ELIN is required for this complex environment, for example,
10 street address, floor number, room number, desk number. In some cases, the ELIN is geodetic, i.e. includes earth coordinates or GPS data.

Modern PBX/MLTS systems provide many new
15 features to accommodate the way modern businesses operate. For example, employees may be assigned personal identification numbers (PINs) that are used by the PBX/MLTS to identify the employee and assign a telephone number to him/her. Further, for example, if an employee
20 is assigned to a different location in the building, an automatic relocation feature can be activated using the PIN to reassign the employee's telephone number to the new location.

25 Another feature of PBX/MLTS systems is that some telephones connected to the PBX/MLTS system may not be provided with the ability to receive direct (inward) dialed calls. For example, in a hotel, telephones in rooms are typically not capable of receiving a direct

inward call from outside the hotel, therefore they have no known Caller ID to identify them to the PSAP.

Still another feature of modern PBX/MLTS systems is that it is possible to make many or even all telephone lines available for use by multiline devices connected to the system. Thus, a caller from behind the PBX/MLTS system may be identified by many different telephone numbers.

10 All of these features of modern PBX/MLTS systems present problems for transmitting call back number and ELIN to a PSAP in an emergency call. In many situations, the only callback number provided from the
15 PBX/MLTS system is the main directory billing number. In situations where the caller has utilized the automatic relocation feature of the PBX/MLTS system, the caller will be identified by employee PIN but not by a specific location. In situations where the caller has no direct
20 inward call receive capability, the PSAP cannot call back the caller in the event of a disconnect. In the situation of a call from a multiline device, the telephone number from which the emergency call is made may not be the primary number for the caller and a return
25 call to that number may cause a different device to ring rather than the caller's device. Moreover, the number used by the emergency caller may be associated with a ELIN which is not the caller's ELIN.

Co-owned co-pending application Serial Number--
--- and co-owned co-pending application Serial Number ---
--- discloses method and apparatus for accurately
reporting the ELIN of an emergency caller behind a
5 PBX/MLTS system to a PSAP.

The methods include assigning a port equipment
number (PEN) to each device/trunk associated with the
PBX/MLTS system, maintaining a database of ELIN and
10 callback numbers associated with PENS, identifying an
emergency number when it is dialed, invoking an emergency
service routing upon detection of a dialed emergency
number, associating the PEN with the dialer of the
emergency number, retrieving the ELIN and callback number
15 from the database, and transmitting the ELIN and callback
number to the PSAP. The apparatus includes database
management means, emergency number detection means, call
routing means, ISDN and non-ISDN signaling means. The
apparatus may be configured so that either the callback
20 number, the ELIN, or both are transmitted to the PSAP.
Further, the apparatus may be configured to recognize
multiple emergency numbers and to give emergency calls
priority over non-emergency calls.

25 The specificity of the ELIN can be determined
by the system administrator and additional text
information may be associated with the ELIN. The call
routing and signaling means are capable of routing the
emergency call through multiple PBX/MLTS systems before

reaching the public network.

One problem that is not solved by the co-owned co-pending applications is the problem of a caller immediately disconnecting an emergency call before the ELIN/callback number can be transmitted to the PSAP. Such a situation might occur in different ways, e.g. criminal activity forcing unintentional hang-up, accidental dialing followed by intentional hang-up, an emergency requiring immediate flight, etc. The PSAP may receive the primary billing number but not the accurate ELIN/callback number. This results in ambiguity for the PSAP. It may be impossible to determine whether the call was a mistake or whether and where the emergency is.

SUMMARY OF THE INVENTION

It is therefore an object of the invention to provide methods and apparatus for accurately reporting the ELIN and/or callback number of an emergency caller behind a PBX/MLTS system to a PSAP.

It is also an object of the invention to provide methods and apparatus for accurately reporting the ELIN and/or callback number of an emergency caller behind a PBX/MLTS system to a PSAP when the caller immediately disconnects.

In accord with these objects which will be discussed in detail below, ELIN/callback number information is buffered immediately upon the detection of an emergency call, upon the detection of an on-hook event prior to transmitting the ELIN/callback number information, a timer is activated and ELIN/callback number information is transmitted from the buffer before the timer expires. When the timer expires, the call is disconnected. Additional benefits and features of the invention will be apparent from the following detailed description taken together with the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a high level illustration of a PBX/MLTS system according to the invention in the process of making an emergency call;

FIG. 2 is a high level block diagram of the apparatus of the invention;

FIG. 3 is a high level block diagram of the call processor and device handler of FIG. 2 used in ISDN service;

FIG. 4 is a high level flow chart illustrating operation of the invention with ISDN service;

FIG. 5 is a high level block diagram of the call processor and device handler of FIG. 2 used in analog service; and

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FIG. 6 is a high level flow chart illustrating operation of the invention with analog service.

DETAILED DESCRIPTION

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Figure 1 provides an overview of an emergency call as originated in a private network (via MLTS 10) on Customer Premise Equipment (CPE) 12.

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According to the invention, the call may be routed directly to the public network 14 or first transit over the private network (via one or more other MLTS 16) to a far end "hop off" to the public network 14. The private network route may include ISDN (e.g., QSIG/PSS1) or analog tie trunks.

20

Furthermore, according to the invention, the ELIN/callback number shall be sent with the emergency call over the private network 12 then to the public gateway MLTS 16. The MLTS 10 or 16 may send the emergency call and ELIN/callback number via an ISDN PRI or analog CAMA (centralized automatic message accounting) trunk to the public network 14. In either case, the Central Office 18 receives the information and routes the

25

call to the proper 911 Tandem Office 20 which routes the call to the appropriate PSAP 22, 24.

A special Automatic Location Identification database (ALI DB) 26 is maintained to match the received ELIN and/or Callback number and display associated information at the PSAP. It is the MLTS administrator's responsibility that the caller information be correctly listed in the ALI DB.

10 Referring now to Figure 2, an MLTS 10 according to the invention includes a database 30, a database administration module 32, a call processing module 34, a device handler 36, an emergency services (ES) module 38, 15 and a dependability module 40. The dependability module 40 provides call recovery functions in the event of an equipment failure.

According to the presently preferred 20 embodiment, the line side of the MLTS 10 includes a an ISDN Primary Rate Interface 42, a private ISDN interface 44 for coupling to other customer equipment, and an analog interface 46 for coupling to either the public network or the private network.

25 As mentioned hereinbefore, on the user side of the MLTS 10, each user equipment is coupled to a unique port and each port is assigned a unique port equipment number (PEN) 48. When an emergency call is dialed, call

processing 34 recognizes the digits and invokes emergency services 38 which, using the PEN 48 retrieves the appropriate information from the database 30. The device handler 36 provides the necessary signaling/outputpulsing
5 depending on the type of trunk used.

Referring to Figure 3, an ISDN call processing module 34 includes a least cost routing (LCR) module 34a and a basic call processing module 34b. The ISDN device
10 handler 36 includes a private Q signaling module 36a and a public primary rate interface (PRI) 36b through which calls are setup and ELIN/callback number data is transmitted via link 36c. According to the invention, the emergency services module 38 includes an immediate
15 disconnect module 39.

When the emergency caller 48 dials (e.g., 911), a connect request internal message is sent to the call processing module 34. The emergency digits are
20 recognized by least cost routing (LCR) 34a and emergency services (ES) 38 is invoked for this call.

According to the invention the emergency digits are recognized on how the unit has been programmed. For
25 example, an indicator on one or more digit patterns in the dial plan flags this as an emergency call when the digits match.

10 This mechanism "triggers" ES processing 38. ES
38 performs all the necessary functions to deliver this
call as a priority emergency call with correct ELIN and
5 Callback Number to the basic call processor 34c. Normal
processing resumes for trunk selection, basic call
establishment sending an internal message with the ELIN
and Callback Number to Device Handler 36. DH 36 formats
the call information appropriately for the trunk which
10 has been awarded.

15 When the trunk is a private trunk, the ELIN
and/or Callback Number (calling party number CPN) are
formatted in a proprietary encoding and signaled with
15 Q.sig 36a. When the trunk is a public trunk, the ELIN
and Callback Number are formatted according to the
primary rate interface 36b protocol. The ELIN and
Callback Number are encoded in the SETUP message sent on
the signaling channel.

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Figure 4 is a high level flow chart
illustrating the logic of an emergency call routed via
ISDN where the station goes on-hook and the call
information is still sent.

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The caller goes off-hook at 50 and dials an
emergency number at 52. At 54 the digits are recognized
and a least cost routing function invokes ES. ES
retrieves the ELIN and optionally the callback number

assigned to the ELIN and stores the information in a buffer. The device handler finds an outgoing trunk at 56 and places the call. If the caller goes on hook at 58, the immediate disconnect routine 39 is invoked. If the
5 caller stays off hook, the call proceeds as normal at 60.

Upon invoking the immediate disconnect routine, a timer is started at 62. The timer is used primarily for an analog trunk and is optional with ISDN trunks.
10 Instead of clearing the call buffers and dismissing the call, a check is made at 64 to see if the timer is running. If it is running, at 66, the call buffers will be retained, a SETUP message is sent with the ELIN and optional Callback number. Upon receiving a CALL
15 PROCEEDING message (i.e., for enbloc-sending/receiving otherwise SETUP ACK for overlap sending/receiving), a DISConnect message shall be sent and the timer stopped. If the timer was not running, at 68, normal processing of clearing the call buffers and dismissing the call occurs.
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Referring to Figure 5, an analog call processing module 134 includes a least cost routing (LCR) module 134a and a basic call processing module 134b. The analog device handler 136 includes a private DTMF
25 signaling module 136a and a public CAMA (centralized automatic message accounting) signaling module 136b through which calls are setup and ELIN/callback number data is transmitted via link 136c. According to the invention, the emergency services module 38 includes an

immediate disconnect module 39.

When the emergency caller 48 dials (e.g., 911), a connect request internal message is sent to the call processing module 134. The emergency digits are recognized by least cost routing (LCR) 134a and emergency services (ES) 38 is invoked for this call. According to the invention the emergency digits are recognized depending on how the unit has been programmed. For example, an indicator on one or more digit patterns in the dial plan flags this as an emergency call when the digits match. This mechanism "triggers" ES processing 38. ES 38 performs all the necessary functions to deliver this call as a priority emergency call with correct ELIN and Callback Number to the basic call processor 134c. Normal processing resumes for trunk selection, basic call establishment sending an internal message with the ELIN and Callback Number to Device Handler 136. DH 136 formats the call information appropriately for the trunk which has been awarded. When the trunk is a private trunk, the ELIN and/or Callback Number (calling party number CPN) are formatted in a proprietary encoding and signaled with DTMF. When the trunk is a public trunk, the ELIN or Callback Number are formatted according to the CAMA module 136b. The ELIN or Callback Number are outpulsed after the destination digits (e.g., 911) during the SETUP enablement on the link 136c.

The analog process is similar to the ISDN process and the ES logic and immediate disconnect component are substantially the same as those used in the
5 ISDN process. The internal messaging 134c to the analog DH 136 may be the same as with ISDN but, in the U.S., only a 10-digit NANP formatted ELIN or callback number may be sent, not both.

10 Figure 6 is a high level flow chart illustrating the logic of an emergency call routed via analog access where the station goes on-hook and the call information is still sent. The caller goes off-hook at 1150 and dials an emergency number at 152. At 154 the
15 digits are recognized and a least cost routing function invokes ES. ES retrieves the ELIN and optionally the callback number assigned to the ELIN and stores the information in a buffer. The device handler finds an outgoing trunk at 156 and places the call. If the caller
20 goes on hook at 158, the immediate disconnect routine 39 is invoked. If the caller stays off hook, the call proceeds as normal at 160.

Upon invoking the immediate disconnect routine,
25 a timer is started at 162. Instead of clearing the call buffers and dismissing the call, a check is made at 164 to see if the timer is running. If it is running, at 166, the ELIN or callback number is outpulsed. If the timer was not running, at 168, normal processing of

clearing the call buffers and releasing the trunk occurs.

There have been described and illustrated herein methods and apparatus for accurate transmission of
5 a ELIN/callback number from an emergency caller calling
from behind a PBX/MLTS after the caller has disconnected.
While particular embodiments of the invention have been
described, it is not intended that the invention be
limited thereto, as it is intended that the invention be
10 as broad in scope as the art will allow and that the
specification be read likewise. It will therefore be
appreciated by those skilled in the art that yet other
modifications could be made to the provided invention
without deviating from its spirit and scope as so
15 claimed.